

## EFFECTS OF THE TYPE OF STIMULUS EMPLOYED AND THE LEVEL OF SUBJECT AWARENESS ON THE DETECTION OF DECEPTION<sup>1</sup>

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An experiment was designed to compare detection of personal material with that of neutral material made relevant only in the experimental context. Each S acted the role of an espionage agent and attempted to conceal both his personal identity and certain code words he had learned. Personally relevant material was found to be significantly more detectable than the neutral material, although consequences of detection were the same for both types. In addition, the study attempted to provide exploratory data concerning physiological responsivity to lie-detection stimuli when Ss were unaware that responses were being monitored. While there was no evidence that detection was inferior under the nonaware condition, difficulties in achieving a completely convincing nonaware situation suggest caution in generalizing from these findings.

Previous studies in detection of deception have reported varying rates of detection which appear to be related to the type or nature of the stimulus situation employed. Lykken (1960), for example, obtained 100% accuracy in matching idiosyncratic material (mother's name, father's name, etc.) to a particular S. Somewhat lower detection rates, ranging from 94% (Lykken, 1959; Marston, 1921) to 50% (Landis & Wiley, 1926), are reported when mock crimes are employed. Still lower rates, ranging from 83% (Ruckmick, 1938) to 40% (Landis & Wiley, 1926), are found with such "neutral" stimuli as numbers, letters, etc. While these studies would suggest that the greater the degree of affect associated with the type of stimuli employed the greater the obtained detection rate, differences between studies in methods

of stimulus presentation, analysis of data, particular physiological measures used, etc., make valid comparisons virtually impossible.

Since systematic comparison of different types of stimulus material within a single study has not previously been reported, a primary aspect of the present study was to explore the importance of the stimulus dimension as a determinant of detection rate. Specifically, detection rates derived from a mock crime type of paradigm similar to one previously used (Thackray & Orne, 1967) were compared with rates obtained from personal or idiosyncratic material.

The study was also designed to provide some exploratory data about S's physiological responsivity to lie-detection stimuli when unaware that his responses are being monitored. A number of studies have suggested that detection of deception is difficult or impossible if S is not motivated to deceive or if there are no consequences to being detected (Chappell, 1929; Gustafson & Orne, 1963). Thus, by eliminating S's awareness of being monitored, he might not at that time be attempting to deceive, would therefore have nothing to hide, and would be difficult to detect. Under nonaware conditions, a difference between personally relevant words and neutral words which achieve relevance only in the context of the experiment might be particularly striking. For example, hearing one's own name is likely to result in a greater

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physiological response than hearing other names independent of the detection-of-deception situation. On the other hand, when deception is not being attempted, such differentially greater physiological responsivity might not occur with material that is relevant only in the context of the experiment.

The physiological response measure employed in the present study was the galvanic skin response (GSR), since previous laboratory studies have shown it to be the single best index of deception (Ellson, Davis, Saltzman, & Burke, 1952; Kubis, 1962; Kugelmas & Lieblich, 1966; Violante & Ross, 1964). To use this measure under a nonaware condition, however, presents certain difficulties. There appear to be no completely adequate techniques for insuring uniform and continuous electrode contact without having electrodes physically attached to *S*. It was felt, though, that a situation might be devised in which electrodes were attached, but in which *S* would believe that no recordings were actually being taken. The situation chosen approximated closely the procedure followed in actual field polygraph examinations. In the field procedure, each question is carefully reviewed with the suspect prior to the actual examination. In the present experiment, GSRs were surreptitiously recorded during this review phase in the hopes of approximating a non-aware condition.

## METHOD

### Subjects

Twenty-eight male undergraduate college students were recruited from local universities. All were volunteers and none had previously participated in detection-of-deception experiments.

### Procedure

The critical stimulus material consisted of three common words and three personally relevant items of information: *S*'s first name, last name, and date of birth. Each critical stimulus was embedded among five similar stimuli. Prior to *S*'s arrival, an assistant randomly selected one card from each of three sets of six cards containing names of common birds, trees, and colors, respectively, which would subsequently serve as "code words" to be learned by a given *S*.<sup>4</sup> He also selected five last

names from a large list of names of similar ethnic origin, five first names from a list of common male names, and five random dates (month and day). The *S*'s own last name, first name, and date of birth were then randomly positioned in their respective sets. The only restriction placed on the sets was that the first item served as a dummy in the interrogation and consequently could never be a significant stimulus.

Each *S* was seen by *E*<sub>1</sub> who explained that the effectiveness of the polygraph as a lie detector was being studied. He was told that he was to play the role of an espionage agent who knows certain critical code words and that he would be given a polygraph examination subsequently by the interrogator (*E*<sub>2</sub>). It was further explained that, due to a security leak, the interrogator was in possession of a pool of code words as well as the names and birthdates of six agents. His own name and the code words to be learned would be contained in this list. To maintain his anonymity, however, he would be introduced as "*S* 27" and the interrogator would not know whether he (the *S*) was one of the individuals whose names he had or whether he was in fact innocent (belonged to a control group who did not receive such information). The *S*'s task was to convince the interrogator that he was innocent and that none of the code words or personal information had any meaning to him. It was explained to him that while it was difficult to deceive the polygraph, some highly intelligent and mature individuals had been able to do so. The *S* was then given a booklet which was constructed to maximize overlearning of the three code words.

After *S* had completed the initial phase of the experiment, he was introduced to *E*<sub>2</sub> as *S* 27. The *E*<sub>1</sub> simultaneously gave *E*<sub>2</sub> the set of stimulus cards specific for the *S*. While no innocent *S*s were used in this study, *E*<sub>2</sub> was actually blind as to the relevant code words and personal information concerning the *S*. As *S* entered the room, the polygraph was in the process of being "calibrated." The technician completed her task and turned off the instruments as *S* was being seated in a strato-lounger chair facing away from the equipment.<sup>5</sup> The *E*<sub>2</sub> treated *S* analogously to the way an interrogator might. He explained the basic operation of the polygraph and stressed the virtual infallibility of the instrument. He explained to *S* that if he were guilty the equipment would certainly register this fact, and he could save considerable time and trouble by confessing (no one did). The interrogator explained that he would go over each of the questions with *S* to make certain there was no ambiguity, surprise, or confusion regarding any of the questions or the procedure itself. The *S* was told that after the familiarization phase, the polygraph equipment

<sup>4</sup> The actual stimuli employed were as follows:  
Colors—PURPLE, ORANGE, BROWN, GRAY, GREEN, BLUE;  
Birds—CROW, PIGEON, OWL, WREN, ROBIN, SPARROW;  
Trees—OAK, HEMLOCK, ELM, SPRUCE, MAPLE, PINE.

<sup>5</sup> The "calibration" was to acquaint *S* with the sound of the polygraph and to reinforce his belief that no recording was being attempted prior to the actual examination.

would be turned on, adjusted, and the examination itself carried out.

Electrodes and transducers for recording GSR and six other variables were then attached. (The remaining variables will be discussed in a separate paper.) The leads from the various electrodes, transducers, and associated equipment were not connected to the polygraph and were left loosely arranged on S's lap. One of these polygraph leads was actually a dummy, however, and led from one of several small transducer boxes located on S's chair. The GSR electrodes led to this box which contained the transmitter and bridge circuit of an FM telemetry system.<sup>6</sup> The GSR was telemetered to a separate room and recorded on a separate polygraph elsewhere. It was explained to S that the electrodes had to be attached at this time in order to allow sufficient time for them to "stabilize" prior to the later polygraph examination.

After all electrodes were attached to the S, E<sub>2</sub> informed him that the questions would now be reviewed with him. Since the purpose of the preinterrogation was to familiarize him completely with all aspects of the polygraph examination which would subsequently follow, S was told not only to listen to the questions, but to answer each with a "yes" or "no" just as he would later during the examination. The S was then questioned on each word in the six stimulus sets. The items were presented by E<sub>2</sub> as informally as possible, allowing approximately 6 sec. between each item to provide sufficient time for the telemetered GSRs to be recorded. Half the Ss received the code-word material first followed by the personal material, while the order was reversed for the remaining half.

Upon completion of the preinterrogation phase, the various leads were connected to the polygraph and the equipment was adjusted by an assistant acting as the polygraph operator. The S was then informed that the examination would begin. Questions were asked in the same order employed in the preinterrogation, and S was again asked to answer each with a "yes" or "no." A 16-sec. interstimulus interval was used to allow for differing latencies in the physiological response measures employed. Following completion of the questions, S was disconnected from the polygraph and taken to E<sub>1</sub> for a post-experimental inquiry.

The data consisted of the telemetered GSRs obtained during the preinterrogation as well as during the "actual" polygraph examination. Since the telemetered data did not yield absolute values of resistance, the magnitude of response was obtained by measuring in millimeters the maximum pen deflection to occur within 5 sec. following the onset of each verbal stimulus. The response to the critical stimulus was ranked against the four control words in its respective set, and a rank of 1 was assigned to the largest response. Mean ranks were then determined for each S on both the code words and the personal items.

## RESULTS

Table 1 displays the mean ranks obtained for both types of stimulus material under the nonaware and aware conditions. A mean rank of 1 would indicate perfect detection; it is noteworthy that in every comparison personal material yields a smaller mean rank than code-word material. To test the possibility of combining orders, comparisons were made between ranks of personal words under both orders of presentation, and likewise between code words under both orders. Separate comparisons were made for the nonaware and aware series. None of the differences was significant at the .05 level (Mann-Whitney *U*; two-tailed). The orders were then combined and the results shown in Table 2. As indicated in this table, Wilcoxon matched-pairs signed-rank tests revealed a significant superiority of personal words over code words.

In order to determine whether detection rate differed as a function of awareness, chi-square tests were separately performed on the personal- and code-word distributions. Since the expected chance value of the mean ranks is 3, the number of mean ranks above and

TABLE 1  
MEAN GSR RANKS ON CODE WORDS (CW) AND  
PERSONAL WORDS (PW) FOR BOTH ORDERS  
OF PRESENTATION UNDER BOTH  
NONAWARE AND AWARE  
CONDITIONS

Condition	Order	Stimulus material	$\bar{X}$ rank
Nonaware	PW-CW <sup>a</sup>	PW	1.38
		CW	1.67
	CW-PW <sup>b</sup>	CW	1.63
		PW	1.23
Aware	PW-CW	PW	1.46
		CW	1.70
	CW-PW	CW	1.55
		PW	1.42

<sup>a</sup> *N* = 13.

<sup>b</sup> *N* = 15.

<sup>6</sup> Onyx Designs, Inc.

TABLE 2

MEAN GSR RANKS ON COMBINED CODE WORDS (CW) AND PERSONAL WORDS (PW) UNDER NONAWARE AND AWARE CONDITIONS

Condition	Stimulus material	$\bar{X}$ rank	$\chi^2$	$T$
Nonaware	PW	1.30	26.03***	26.5**
	CW	1.65	22.32***	
Aware	PW	1.44	21.33***	38.5*
	CW	1.62	26.03***	

Note.— $N = 28$ .

\*  $p < .025$ , one-tailed test.

\*\*  $p < .01$ , one-tailed test.

\*\*\*  $p < .001$ .

below this value was determined for each distribution and evaluated against the expected frequencies. As Table 2 indicates, the four chi-square values were significant, indicating better than chance detection under both awareness conditions. To test for any relative superiority of the two conditions, a comparison was made between ranks of personal words in the nonaware and aware series. Likewise, a similar comparison was made between ranks of code words in both series. Wilcoxon tests yielded nonsignificant  $z$  values of 1.09 and .09, respectively.

During the postexperimental inquiry each  $S$  rated how detectable he thought he was on the three personal-word and three code-word items. Mean ranks for these two types of stimulus material were determined for each  $S$ , and the difference between the distributions tested with a sign test. Results indicated  $S$ s felt themselves to be more detectable on the personal-word material ( $p < .001$ ).

### DISCUSSION

Previous research has focused on the consequences of detection and  $S$ 's motivation to deceive as significant variables affecting the likelihood of differentially increased physiological responses (Gustafson & Orne, 1963, 1965). In the present study, responding to either personal items or code words would lead to detection. The  $S$  was aware that a response to either type of stimulus would have the same consequences; that is, he would

reveal himself to be a guilty person. Yet, the results indicate that detection of personally relevant material is superior to relatively neutral stimuli which are made relevant only in the context of the experiment. If  $S$ 's motivation to deceive and the consequences of deception are held constant, however, it seems reasonable that personal material would be more likely than code material to evoke some form of emotional response. These findings are not inconsistent with previously reported results that situational factors have marked effect on detection rates, since significant detection was achieved with neutral stimuli made relevant in the experimental context. Thus, one would expect a decrease in detection rates with both kinds of stimuli in a situation where motivation is markedly reduced. The findings do suggest, though, that situational determinants alone are not sufficient to account for the obtained detection rates. If detection were only a function of its consequences, personal material would not have been detected better than code-word material.

The differential response between personal-word and code-word material observed in the present study is consistent with the findings of Oswald (1962, pp. 47-50) that  $S$ s during sleep are more likely to rouse to their own name than to other stimuli presented at equal volume even if motivating contingencies are associated with other stimuli, though motivating contingencies do affect the probability of arousal to previously neutral stimuli during sleep. Whether one wishes to conceptualize the observable difference of response to highly relevant personal material (such as one's name) as due to past differential affective conditioning or to differences in meaning is largely a matter of semantic preference. That personally relevant material tends to evoke a differential affective response has also been shown in quite a different context in the work of Wolff (1943). He found that individuals gave a greater emotional reaction to their own forms of self-expression even when these were not recognized as such. The detection-of-deception paradigm used here is one where  $S$ 's physiological response to a particular stimulus is compared with that to other similar stimuli. In past research (Gustafson & Orne, 1963),

it has been shown that previously neutral stimuli can be made relevant to the experimental situation and yield differentially greater physiological responses. The previous work by both Oswald and Wolff has shown that personally relevant stimuli yield greater affective responses than neutral stimuli in a situation other than a detection-of-deception experiment. The authors of this study would interpret their findings to suggest that the two sources of increased physiological responsiveness, situational and preexisting personal relevance, may each independently contribute to detection.

The Ss rated themselves as more detectable on personal than on code material in the post-experimental inquiry. A clear interpretation of this finding is difficult. They may have perceived themselves as responding to personal items during the polygraph examination or they may merely have expected that personal material should be more detectable than code words. Further research is needed to clarify the results.

In designing the present study, it was hoped that the nonaware condition would allow a comparison between personal- and code-word stimuli in a situation where, as far as the S knew, a physiological response would not have the consequence of detection. Under these circumstances one might expect that the code words would fail to yield a greater physiological response than their appropriate control stimuli, whereas this might not be the case with idiosyncratic or personal material. This difference in relative response to the two classes of stimuli might become smaller or disappear entirely under the aware condition of interrogation, since at that time the S would be motivated to attempt to conceal his physiological responses to both code words and personally relevant words.

The actual findings indicated no significant differences between these two conditions. Personally relevant words yielded differentially greater physiological response than code words in both conditions: however, code words themselves were identified as readily in their nonaware condition as in their aware condition. It is of course possible that Ss did not believe appearances and thought that somehow they might still be monitored

(as indeed they were) during the nonaware condition. Not only was every possible precaution taken to minimize suspicion, but very careful postexperimental inquiry was carried out on this issue. Only one S appeared to have any suspicion in this regard; most Ss, however, verbalized feelings of discomfort during the nonaware condition. They indicated they felt strange having all the electrodes attached to them and anticipating the forthcoming polygraph examination. Some Ss even indicated that if they had been recorded during this initial period detection probably would have been easier than during the actual examination. It would seem that having a great many electrodes attached and expecting the forthcoming polygraph examination created a condition for most of the Ss that was similar to that of the actual interrogation. It should be emphasized that Ss did attempt to deceive E during the preliminary part of the examination. Further work will be needed to clarify whether the augmented GSR associated with the code words under the non-aware condition was a function of the S's motivation to deceive E independent of his belief that records were being obtained or whether it was related to the number of electrodes that were attached to S and the special situation in which he found himself. A definitive answer about the effect of the awareness of being monitored on physiological responsivity will require considerably more investigation, and great care should be taken in generalizing from the findings reported here.

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